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ABSTRACT

The level and character of school investment affected the national economic output in agriculture and industry in Mexico during two periods, 1880-1910 and 1920-1925. Prior to the 1910 revolution, the Mexican government encouraged urban-centered industrial development, and schools were mostly locally- controlled, urban institutions. In post-revolution Mexico (1920-1925) a rural-focused strategy of agricultural development that discouraged industrial investment was adopted, and the federal government took control of schools, giving top priority to rural areas. Federal statistics on schools and economic activity in these two eras were analyzed, using production-function and panel analysis models. The level of school investment prior to the revolution was found to be negatively associated with agricultural growth, perhaps because of the urban focus of schools during this time. After 1920, school investment--now focusing on rural development--had a positive influence on agricultural output. Conflicting positive and negative effects of literacy on industry were observed prior to 1910. After 1917, however, school investment and quality raised aggregate manufacturing output. (RM)

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THE INFLUENCE OF SCHOOL QUALITY ON ECONOMIC GROWTH: AN HISTORICAL LOOK AT MEXICO, 1880-1945

Bruce Fuller
Kathleen Gorman
John Edwards

Introduction Faith in the belief that education helps drive economic growth has dwindled considerably over the past decade. Research within industrialized nations seriously challenges the assumption that higher levels of school investment and quality will boost the individual's academic achievement or eventual economic success in the labor market (Coleman et al., 1966; Jencks et al., 1979). Prior estimates of the contribution of educational attainment to national economic growth (Denison, 1967; Schultz, 1971) now also appear to have been overly optimistic (Barnhouse-Walters & Rubinson, 198[illegible]).

Yet findings from research within industrial nations on achievement and economic effects of school investments should not be generalized to developing countries, nor even applied to all historical periods within any state. Recent work, for instance, reveals that incremental improvements in school quality have yielded sizable student achievement gains in several Third World nations (for review, see Psacharopoulos, 1983). The relative influence of school attainment and quality vis-a-vis family background also appears to be much stronger in developing countries than within industrial nations (Heyneman & Loxley, 1983). School investments may also be more potent within the Third World in boosting the individual's labor market success compared to more industrialized nations. In Chile, for example, school quality--including textbook availability and class size--were strong determinants of occupational success (Schiefelbein & Farrell, 1984).

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This paper asks whether school investment contributes to economic output at the national level. The economic effects of schooling quantity and quality are usually examined by following individuals from school into the labor market. But the structure of the economy is assumed to be constant--that through which the individual moves (Bowman, 1976). Work has just begun directly measuring the influence of school investment on national-level productivity and growth, moving beyond growth-accounting methods or inferring social returns of education from aggregated individual-level experience (for review, Rubinson & Ralph, 1984). Our project is an initial attempt to directly assess the impact of shool investment and quality on national-level output in a Third World country.

We report on education's contribution to early agricultural and industrial growth among the Mexican states between 1880 and 1945. Mexico offers an intriguing case. Prior to the revolution (1910-17), Mexico strongly encouraged urban-centered industrial development, spurred by infusions of foreign capital. After the revolution, Mexico shifted toward a rural-focused strategy of agricultural development, discouraging investment in mining and manufacturing (Reynolds, 1970a). Investment patterns in schools also changed dramatically between these two periods, corresponding to the sharp switch in social priorities. Schooling moved from a locally controlled, largely urban institution to a federally dominated movement, designed to help organize rural communities around shared economic and social goals. Mexican history thus provides an opportunity to examine the impact of school investments on growth under two distinctive economic structures and via contrasting education policies.

School Investment and National Growth This study builds on, yet departs somewhat from, the way economic effects of school investment have been studied within the human capital framework. Current debate over school

investments and whether they boost academic achievement or economic benefits is exposing limitations both in how the issue has been conceptualized and in research methods which are often employed. Our look at the contribution of school investment and quality to economic growth in Mexico responds to the following points of criticism directed at past literature.

Much of the research on economic returns to educational investment has utilized individual-level data, typically examining how youth with variable levels (and quality) of schooling achieve within the labor market (e.g., Hansen, 1970; Psacharopoulos, 1973; Sewell & Hauser, 1975; Bowman et. al., 1981). The human capital assumption in this work is that schooling imparts skills and attitudes which lead to greater productivity, measured in terms of wage gains and aggregated social returns. However, class-conflict theory suggests that wage effects of schooling may result from higher credentials held by some youth, not necessarily from higher technical proficiencies gained in the process of education. Schooling level could consistently covary with individuals' relative positions in the labor and wage structure; yet aggregate productivity and national growth is not necessarily affected (Berg, 19709; Thurow, 1974; Collins, 1979). The traditional human capital framework also assumes constant labor demand patterns -- the economic structure presumably discriminates between individuals (holding variable skills and educational attainment) in similar ways over time (Bowman, 1976). However, at times the labor market favors low or high status subgroups. Higher rates of return from education for blacks in the U.S. during the 1970's provides one example (Hanushek, 1979; Rizzuto & Wachtel, 1980).

We view the school investment process as one which largely occurs at an institutional, not only at an individual or family level. Particularly within early stages of national economic development, investment in school quantity and quality is part of institution-building processes designed to

boost education levels, technological innovation, regional trade, and a national consciousness (Meyer, 1977). Investment in schools by government at local, state, and national levels expresses a desire to integrate individuals and communities into a more tightly organized economy and social structure. Schooling establishes universal understandings, a common language, a wider-based political order (Bendix, 1964; Althusser, 1971). Individual-level research may actually underestimate the economic effects of school investment by missing institutional and regional events--the accumulation of knowledge, for instance. In addition, regional or national educational investment decisions may differentially shape growth in various economic sectors. One question in this study is whether post-revolutionary Mexico was able to boost agricultural production through schooling investments. This is one example of how school investments may be an exogenous force, complementing capital investment strategies, which focus on growth in a particular economic sector (at the community level, see Jamison & Lau, 1982). The central point is that school investment at national or regional levels may better capture economic benefits or costs than individual level analyses.

The growth accounting method of estimating education's contribution has also been used to examine national-level economic effects of education (Denison, 1967, 1974). However, simply assuming that the residual of economic growth not explained by capital, land, and labor inputs was shaped by education and technological innovation may have over-estimated the impact of schooling investments at the national level. Barnhouse-Walters & Rubinson (1983), directly measuring and modeling the impact of education attainment, found a significant effect of primary schooling on national output. The influence was considerably less than growth accounting methods had estimated, and the effect appeared only for the United States' early industrial period

(Note 1). We draw on the production-function method to model longitudinal effects of school investment, assessing the economic impact of alternative measures of investment in school quantity and quality after controlling on the effects of capital, labor, and cultivated land (Hanushek, 1979).

Quantity and Quality Dimensions of School Investment Early research defined school investment (for individuals and nations) as the quantity of schooling attained, for an individual or a nation's labor force. But school investments can have several qualitative components as well. School quality has been measured in terms of per student expenditures, character of school facilities, strength of academic programs, class size, social composition of students enrolled, and teachers' salary levels or qualifications (for review, see Solmon, this volume; Welch, 1976). These quality ingredients of schooling have been found to influence both individual-level academic achievement and success in the labor market. Expenditures per pupil, the ratio of students to teachers within the school, and teacher salaries appear to significantly influence school and economic experience after controlling on family background within the U.S. (Wachtel, 1975; Aiken & Garfinkel, 1977; Rizzuto & Wachtel, 1980). Initial evidence suggests that school quality (in terms of expenditures per pupil) also shapes rates of growth in pupil persistence through school and state-level income, controlling on earlier school expansion efforts (Solmon, 1975; Fuller, 1983). While a trade-off appears to exist between the quantity of investment and school quality, little is known about which qualitative factors and what mix yield the greatest academic achievement and economic effects.

The distinction between school expansion and school quality is particularly important in assessing educational investment effects in the Third World. For instance, in the 36 poorest nations (per capita GNP US$265 or less) average enrollment rose from 48 percent to 70 percent of school-age

children between 1960 and 1977 (Heyneman, Jamison, & Montenegro, 1984). Yet within this remarkable spurt of institutional growth and access to education lie vast variations in school quality. In teacher salaries, for example, Malawi spends at a level equal to just one-sixth of the resources allocated by Bolivia (Heyneman), 1982). Contrasts are even sharper between industrial and less developed nations. In 1975, OECD member nations spent 35 times more resources per student than the world's poorest countries (World Bank, 1980). In 1977, 10 students are enrolled for every one textbook in the Philippines (Heyneman, Jamison & Montenegro, 1980).

Variation in school quality also touches levels of academic achievement. Looking across 29 low-income nations, Heyneman & Loxley (1983) found that school quality shapes sizable portions of variance in students' achievement. In the poorest nations, such as India and Columbia, school quality played a stronger role than family background. Incremental improvement in the availability of textbooks, instructional materials, and even radio instruction have revealed similar gains in achievement among students in Nicaragua (Jamison et al., 1981), Malawi (Heyneman, 1980), and Malaysia (Haron, 1977). Effects are at times quite significant. A control-group evaluation of increasing textbook availability in the Philippines, for instance, found an increase in one-third of a standard deviation in first and second grade math achievement across 8 million students. This means that the level achieved by one-half of all students in year one was attained by 63 percent of all pupils the next year after introducing additional textbooks (Heyneman, Jamison and Montenegro, 1984).

However, little evidence exists which links school quality to economic gains within the Third World. The previously cited study in Chile is an important exception - where textbook availability, teaching quality, and class size contributed to labor market success more efficaciously than length

of schooling (quantity) or family background (Schiefelbein & Farrell, 1984). Jamison & Lau (1982) also found that persistence through four years of elementary schooling raised individuals' farm productivity by nine percent. This study is important in that the dependent economic effect was measured in terms of concrete output (rather than employing wage rates as a proxy for presumed productivity gains), and growth effects pertain to one particular economic sector. Our work on Mexico extends this line of work, relating school investment levels and qualitative aspects of states' investments to economic output over time.

Historical Specificity of School Investment Effects Special effects from school investments may occur only within certain periods of development or particular economic structures. Human capital research at the individual level has not examined variation in the structure of occupations nor the dynamics of labor demand patterns as change occurs over historical periods. Analyzing worldwide data on educational attainment across nations, Benavot (1982) found that levels of investment in primary schooling boosted economic development for poorer countries but not within more industralized nations over the 1950-1970 period. Similarly, Barnhouse-Walters & Rubinson (1983) found that primary schooling significantly helped predict early industrial growth in the U.S. (1890-1929), while secondary schooling nudged development after 1933. Technological innovation and assumed shifts in job skills may also have boosted primary school growth in the former period, then reinforced secondary school expansion in the late industrial period (Rubinson & Ralph, 1984). This work does not emphasize how differing dimensions of investment quantity and quality may variably influence economic growth under specific historical conditions; yet focusing on the efficacy of different levels of instruction and types of curriculum (for example, primary versus secondary, or

academic versus vocational) offers a strong beginning point for future research.

Which Direction Causality? Past approaches to studying the effects of human capital investment have been critized for modeling the process in the wrong direction. Rather than arguing that school investments boost economic growth, the class-conflict perspective proposes that the economic and state structure determines the growth and character of school institutions (Bowles & Gintis, 1976; Collins, 1979; Hogan, 1982). Little doubt exists that labor market demand in part shapes school enrollment rates and school investments by states. Supportive empirical evidence exists both for industrializing settings (Katz et al., 1982; Fuller, 1983) and within developing countries, such as Mexico (Goldblatt, 1972).

The present paper, however, focuses on a model which views school investments and quality as antecedents to economic growth. The rise of school institutions preceded commercial expansion and industrialization in many settings, including 19th century France (Baker and Harrigan, 1980), the U.S. (Fishlow, 1966; Meyer et al.,, 1979), and Mexico (Diaz Covarrubias, 1875; Wilson, 1941). To some extent social values and commitment to school institution building -- often rooted in religious convictions and faith in literacy training -- operate somewhat independently of economic factors (Lipset, 1972; Tyack & Hansot, 1982). In addition, schooling investments in time 1 historically precede growth in certain emergent industrial or commercial sectors in time 2. This reality necessitates looking at the economic structure as a dependent variable. We do not assume that school investment patterns are not affected by previous social class structures, even those operating within early agrarian and local commercial elements of the economy (Soltow & Stevens, 1981). School investments may also allocate economic gains within unequal patterns (Carnoy, 1972; Levin, 1984) -- as well

will see in pre-revolutionary Mexico. Yet our focus here is on the extent to which school investments and quality may spur growth in new or young economic sectors of a developing nation.

In summary, we look at how measures of school quality among Mexico's 32 states have affected economic output over the 1880-1945 period of economic development. This approach allows us to assess the role of educational investment and quality on direct measures of economic output. Before detailing our method and findings, Mexico's school investment policies and patterns of economic growth are outlined. This sets the theoretical issues within Mexico's own historical context.

Historical Sketch: Aims and Quality of Mexico's Schools Two elements of Mexico's educational history are especially pertinent to the discussion of school quality. First, is the issue of who controls the financing and administration of the schools. Second, is the question of how the content of schooling matches eonomic and social priorities held by the nation.

Education in colonial Mexico was largely controlled by the church. Secular elements of the government successfully advocated public support of schools only after Mexico achieved independence from Spain in 1821. Liberal reforms of the independence era and during La Reforma in the 1850's would eventually constrain the church's ability to even operate primary schools. Yet an increasingly secular federal government would not replicate the church's level of centralized administration until after the 1910-1917 revolution. Throughout the latter half of the 19th century, primary education occurred within private schools or small institutions supported by municipal governments (Larroyo, 1948; Wilson, 1941). In 1895, 87 percent of Mexico's 8,103 primary schools were operated by municipal authorities, 603 were

supported state governments, and the remainder by churches or private associations (Hamilton, 1884; Diaz Covarrubias, 1875).

The federal government did play a role in urging establishment of public free schools, both during the reformist administration of Benito Juarez and in the early years of the Porfirio Diaz regime. The organic laws of public instruction (1867) required municipalities to establish a primary school for every 500 inhabitants and urged hacienda owners to create schools for the children of farmworkers and miners (Universidad, 1967; Vaughan, 1982). In 1875, the Diaz administration mandated school attendance for all school-age children. Ironically, this mandate was exercised when not more than one-fifth of all children entered primary school and only 15 percent of all Mexicans were literate. Not until 1888 did the federal government begin to subsidize schools run by the states and municipalities.

Local control of education greatly influenced school investment and quality. In the 1870's, annual expenditures per student enrolled in public schools equalled only 5.4 pesos, equivalent to two weeks wages of a farm laborer. But in private schools, 24 pesos per child were expanded (Diaz Covarrubias, 1875). Urban families and children benefitted most from private schools. Within the Federal District (Mexico City), 40 percent of all primary schools were private. Municipalities which prospered from coastal trade or mining were better able to raise public revenues for schools. Urban philanthropists and private societies also helped support schools (Banda, 1873); Note 3). In addition, economic firms -- particularly in mining -- created their own schools to ease labor shortages (Maillefert, 1865; Wilson, 1941).

Initially, municipal and private primary schools simply borrowed curriculum and materials from the Catholic institutions, emphasizing classical training in morality, religious doctrine, and the humanities. Yet from the

mid-1800's the secular state would recurrently encourage more Western educational philosophy. Reformers argued that schooling should not just teach conformity through strict instruction and recitation. Instead, education should nurture the individual development necessary for political independence and economic success within a post-colonial, free market economic structure (Sierra, 1969; Knowlton, 1976). Curriculum and policy emanating from the federal government -- along with the subsidies -- increasingly argued that schools should impart job skills and social norms which were closely linked to modern sector jobs and urban lives. Instruction in "urbanity," the French language and moral behavior were integrated with older curriculum in mathematics, science, and history (Album, 1909; Sierra, 1910; Benjamin and Ocasio-Maléndez, 1984; Note 4). This coupling of public primary schools and the modern urban economy occurred even though two-thirds of all workers (in the formal labor market, 1900) were engaged in agriculture, not urban commerce or manufacturing.

The growth in school investments prior to the revolution was remarkable. The number of primary schools in Mexico rose from 5,240 in 1843 to 10,592 in 1902 (Table 1, Ortiz, 1939). Yet by 1907 less than one-third of all children were enrolled in primary school, and a third of those enrolled attended school infrequently. In poor states, such as Chiapas and Oaxaca, less than 20 percent of all children ever enrolled in a primary school (Vaughan, 1982). Twenty-five years after compulsory attendance laws were passed, states and municipalities were still inducing higher attendance by giving students free clothes and meals and by threatening parents with fines or even jail for failing to send their children to school (Calcott, 1965).

Beyond low levels of educational investment per capita and low enrollment rates, concrete signs of variable school quality were apparent. Teachers, supported by municipal governments, earned about 25 pesos a month in

the 1870's, roughly the same wage of a carpenter and less than that of many mine workers (Wells, 1887; Vaughan, 1982). Rural school teachers earned as little as one-fourth the wages paid in commercial centers. During this period, only five normal schools existed to provide formal teacher training. Quality standards when set by state or local governments were symbolic at best. In Chihuahua, 1909, all schools were to have labs, a sink, bathroom, and a playground; only two schools met these benchmarks (Sierra, 1910). Teachers were at times evaluated on the basis of their students' performance on exams -- an 80 percent passage rate deemed as satisfactory by school inspectors. Yet as late as 1927 over 40 percent of all first grade students did not pass the national exam (see Note 2 for primary data sources).

The quality of rural schools -- where they managed to operate -- was very low. In 1910, the state of Zacatecas closed many of its 251 rural schools due to inadequate buildings and an inability to find teachers (Vaughan, 1982). Double standards of quality were also applied to rural schools. In the early 1900's the federal government approved a national school calendar, but allowed rural areas to ignore it during planting and harvest seasons. While urban schools were inspected for the quality of instruction in math, science, and modern languages, rural schools were expected to focus on manual skills, "intuitive knowledge," and learning Spanish (Sierra, 1910; Boletin, 1909).

Post-1917 School Investment Successive federal administrations implemented a major redirection of school investments following the 1910-1917 revolution. Implications for school quality can be examined through the same two elements summarized for the pre-1917 eras: Who controls school investment policy? How were the quality and character of schools shaped to help push economic development?

First, the federal government assumed strong central direction of school investments. Between 1910 and 1923 annual federal support of schools grew from 9 million to 29 million (constant, 1923) pesos (Lacandon, 1923). The number of federally-built primaries increased five-fold during this time. By 1925, the federal government provided just over one-half of all public funding for schools. The once dominant share of municipal governments had fallen to less than 10 percent of all apportionments (Stanley, 1948; Note 5). Spurred by this rising federal investment, 46 percent of all school-age children were at least registered in school by 1927.

Second, this burgeoning level of federal investment in schools was focused on rural development -- aiming both to boost agricultural productivity and to improve quality of life in the countryside. Revolutionary ideals of this era were embodied by the vision of raising literacy, integrating Indians into the modern state, and equitably redistributing land and wealth to rural peasants (Sanchez, 1936; Ruíz, 1963). Over 80 percent of primary schools built by the federal government between 1907-1928 were located in rural areas. Between direct federal support and strengthened mandates on ranchers and factory owners to open classrooms for their workers, the number of rural schools rose from just over 1,000 in 1921, to 13,700 in 1947 (Secretaria, 1926; Wilkie, 1970).

Third, the content of primary schooling also shifted to emphasize rural development. The revolution had to some extent repudiated free market, individualistic economic values and instead urged cooperative agrarian and industrial action to boost domestic productivity (Tannenbaum, 1964). Rural school "missions" became the tool for organizing villages in the countryside -- addressing problems of illiteracy, primitive farming techniques, and poor health care in a comprehensive fashion. The rural teacher was part instructor, part community leader (Sanchez, 1936). Many rural schools

operated collective farms (attached to ejidos), ran small industries such as furniture-making, raised chickens, and operated cooperative banks for their village (Callcott, 1931). The rural school movement was in part a manifestation of the government's desire to encourage a national consciousness which emphasized a national Mexican identity, independent of foreign business yet also assimilating various regions and Indian groups into a cohesive social framework (Vasconcelos, 1923; Ramos, 1941). The secular state communicated themes of cooperation, solidarity, and national self-reliance through the rural schools (Ebaugh, 1931; Note 6).

Despite these gains in building school institutions, quality was mixed. In 1927, for instance, 43 students were enrolled for every one teacher. Ninety percent of all rural schools consisted of one large room, containing only tables and chairs with very few instructional materials. In this same year, enrollment in the third grade was just 10 percent the level of first grade enrollment (Stanley, 1948). As late as 1950, 60 percent of all children enrolled attended the first grade (Myers, 1965). In 1920, the state of Sonora -- even though the education appropriation was 15 times higher than the level prior to the revolution -- was spending only six pesos per capita on public education (about two days' wages of a railroad worker, Bell, 1922). Trained teachers were in very short supply, particularly given the rapid rate of school expansion. Wage rates did not indicate, however, a shortage of people willing to join the movement. Rural teachers entered the federal school system earning two pesos a day, comparable to workers in manufacturing (Wasserman, 1984).

The federal government addressed issues of quality by combining centralization of standards with encouragement of local commitment. Villages were asked to donate land and labor to build and support the rural schools. Centrally, the national administration standardized curriculum, enforced

national examinations, and expanded (both pre- and in-service) teacher training (Sanchez, 1936). While improvements in quality took a long time to implement, Mexico's expansion of school investment had tangible effects. For example, the nation's literacy rate increased from 23 percent in 1910, to 42 percent in 1940 (Wilkie, 1970). Further, the correlation between federal per capita expenditures on primary schools (1927) and the literacy rate (1920) among the states was inversely related ($r = -.79$, $p < .001$). This represents a determined effort by the federal government to focus school investments on those areas where literacy was low. By 1940 the correlation between this 1927 school investment measure and the literacy rate is strongly positive ($r = .43$, $p < .02$), indicating that illiteracy was turned around in at least several states where federal investments were concentrated.

This brief historical outline of Mexico's educational investments and the resulting variable quality of schools (our antecedent factors of interest) should be matched against a brief sketch of economic development patterns (the dependent variables) over the 1880-1945 period. These two historical maps will help to illuminate our empirical models and aid in the interpretation of our findings.

Historical Sketch: Economic Development Patterns Mexico maintained a colonial economic structure into the early 1900's, based on the export of minerals, tobacco and tropical fruits, and livestock. As early as 1810, rising domestic demand had also spurred modest production in manufacturing, particularly within a modest textile industry. In that year New Spain's output was distributed across mining (15 percent of total value), manufacturing (29 percent) and agriculture (56 percent; Meyer & Sherman, 1979). In 1884, (US)$37 million in gold and silver were exported, comprising 75 percent of all exports (Hamilton, 1884).

This economic structure was reinforced between 1877-1910 under Porfirio Díaz' administration. Díaz encouraged foreign investment and encouraged growth in domestic manufacturing. During this period foreign trade increased four-fold. By 1916, (US)$647 million in capital was invested in the mining industry, 95 percent from the U.S., Britain, and France. By 1899, 118 cotton factories operated, centered primarily in the Federal District, Puebla, and Jalisco. Mexico's gross national product increased at an annual rate of 3.7 percent during the 1876-1910 period, compared to a 1.6 annual rate of growth over the 1920-1940 post-revolutionary era (Derossi, 1971).

Agricultural exports grew by 47 percent in the last decade of the 19th century (Note 7). Yet the aggregate value of Mexico's agricultural production (1882) was low relative to international standards, only equalling the value of oat production in the U.S. Díaz did little to urge greater rural productivity, already constrained by a feudal agrarian order dominated by haciendas and ranchos. In 1910, 97 percent of rural family heads owned no land at all. Mexico's 840 hacendados controlled most cultivated land and relied on inexpensive farmworkers rather than investing in more productive technology (Hagar, 1916; Calcott, 1931; Glade & Anderson, 1963; Cockcroft, 1968).

Mexico's shift toward rural development and nationalization of heavy industry were clearly felt following 1917. Tables 2a and 2b report the structure of Mexico's gross domestic product and economic growth rates before and after the 1910-1917 period of reform. Discouragement of foreign investment and eventual state control of rail and petroleum companies greatly reduced available capital (Mosk, 1930; Reynolds, 1970a). Federal policy was, however, efficacious in boosting agricultural productivity. The annual growth rate moved from 3.6 percent in the 1900-1910 period to 4.3 percent between 1925-1940 (Table 2b).

The regional geography of Mexico's economic development is also an important point of background. Historically, centers of production were located in rural areas around mines and haciendas, while the nation's more than 50 costal ports grew on a base of trade, commerce, and government activity. At times, both hacienda owners and mine operators were faced with wage competition from the modernizing sectors of more urban economies. Similarly, the textile industry moved from hiring mostly men to employing more women in the latter third of the 19th century (Wells, 1887; Chavez Orozco, 1937). In addition, increasing mechanization of factories, price competition working against small-scale household industry, and expectations of land reform recurrently increased migration from the city back to the hinterlands (Reynolds, 1970a). This issue of inter-sector migration is important in conceptualizing how school investments might differentially influence growth or decline within different economic spheres. Rural-based textile factories payed higher wages than working farms (Nash, 1958). In turn, urban manufacturers and commercial firms paid more when having to compete with labor demand in government and trade enterprises. As education presumably expanded job alternatives, wage competition and costs increased within certain sectors, just as improving the labor supply's quality may lowered wage competition in other sectors. In sum, economic growth effects of school investment may vary depending on the economic sector (Hage, 1980).

Linking School Investment and Quality to Economic Growth Several variables related to school quality and economic development were coded for Mexico's 31 states (or territories) and the Federal District (30 jurisdictions prior to 1910). This study examines how variation in school investment patterns among these units helps to explain increments of growth or decline within economic sectors between 1880 and 1945. To illustrate covariation between school quality and economic development, Table 3 contrasts those

states with the highest levels of school investment versus those states which were the least committed to educational institutions.

First, we report on state variation regarding several indicators of investment and quality. For instance, the high investment states spent 51 centavos per capita on schools in 1888; the states with low investments expended only 16 centavos annually. High investment states possessed a 29 percent literacy rate, versus only 6 percent in low investment jurisdictions. Table 3 also illustrates the complexity of school quality measures. The number of students enrolled per teacher was considerably higher in high investment states, counter to expectations. Higher enrollment rates per capita did not necessarily mean that institutional resources could keep pace with demand.

Table 3 then reports how the economies differed for those high and low investment states 12 years later in 1900. We do not infer causality based on these simple tabulations; group differences are interesting, however. Low investment states were more rural, had lower mine and cigarette production, yet comparable agricultural and textile output relative to high investment states. Manufacturing related to tobacco was generally urban-based, while textile factories were distributed in both urban and rural areas (Note 8). State wealth linked to school investment levels also appears to have stemmed both from rural agricultural production and urban-centered industry.

Study Design: The Data Several federal agencies published statistics on schools and economic activity in each of the two periods we are studying: 1880-1910 and 1920-1945. The data come from federal surveys and budget documents related to school support, tax reports on agricultural activity and various industries, and commerce reports. In addition the decennial census, begun in the 1890's, provides figures on occupations, school attainment, and literacy (see Note 2 for a complete list of the data

sources). Very few of the indicators necessary for conventional time-series analyses were published annually. Instead we have employed both modified production-function and panel-analysis models which utilize data falling into four panels: the 1880's (Time 1), 1900-1910 (Time 2), 1923-1928 (Time 3), and 1940-1945 (Time 4). Our models examine the influence of school investment and quality in Time 1 and Time 3 on economic output measures in Time 2 and 4, respectively.

Models The production-function model constructed for both the pre-1910 and the post-1920 periods adopts the Cobb-Douglas approach. For example, the influence of school investment and quality indicators on economic output are examined after controlling on production inputs: capital investment (Cap), the labor participation rate (Lab), and amount of land (Land) under cultivation. For example:

(Output $_{s,t}$) = $a * (Cap_{t-2})^b * (Lab_{t-2})^{c*} (Land_{t-2})^{d*} (Lit_{t-2})^{e*} (SI/SQ_{t-1})^f$

Where s = a particular economic sector and t = time (t-1 is Time 1). Production inputs are assumed to hold a simultaneous influence on output. Literacy (Lit) is a candidate variable for entry, and school investment (SI) and school quality (SQ) measures, lagged from Time 1, are allowed to enter the equation (using a p .10 level of statistical significance). Given the limited number of cases (30 over Time 1-Time 2, and 32 cases over Time 3-Time 4), no more than three school quality measures were allowed to enter any regression equation. The Cobb-Douglas model assumes interaction between all independent variables. Logged values for variables on both sides of each equation are reported, allowing use of least-squares regression while retaining the model's multiplicative character (Walters, 1970; Barnhouse-Walters & Rubinson, 1983).

Note that we are observing the level of variables at two points in time (for both the 1880-1900 and the 1925-1945 eras) and studying variation among Mexico's states. Capital investment, land, labor, and literacy are assumed to have an impact output in the same year; school investment and quality measures are lagged by 12 to 20 years, depending on data availability. This builds from the traditional production-function approach. Yet rather than using annual time-series data, observations across the Mexican states are utilized for each panel of data.

The second approach employs conventional panel-analysis models where the influence of school quality in Time 1 (and Time 3) on economic output in Time 2 (and Time 4) is examined, holding economic activity in Time 1 (and Time 3) constant. This approach assumes that prior levels of economic output will largely determine output 10 or 20 years later, but a portion of the unexplained variance may be shaped by school investment patterns. Rather than controlling on capital, land, and labor in Time 2, the level of economic activity in Time 1 (for each economic sector) is controlled on. School investments are then entered to examine the influence on output in Time 2. For instance:

$$\ln(\text{Output}_{s/t-2}) = a + b*\ln(EA_{s/t-1}) + c*\ln(Lit_{t-1}) + d*\ln(SI/SQ_{t-1})$$

Again, literacy and school investment measures are candidates for entry based on a minimum significance criterion. This panel-analysis approach allows the combining of economic indicators within sectors where reliable composite measures can be constructed, rather than differentiating between capital, land, and labor inputs. This may help to stabilize models, particularly when using a moderate number of states or cases. The natural log of output,

economic activity (EA), and school investment measures are taken to ensure comparability with the production-function model.

Exact measures of some economic variables did not always exist for two time periods; yet in most cases composites could be constructed which showed strong correlation across the two periods, providing efficacious control measures. This is an important point related to the validity of inferring causality from these longitudinal analyses (both production function and panel analyses). For example, where production inputs and controls do not show expected association with the output measures, any relationship between school investment levels and output may be simply related to variation in state wealth. But when the controls and inputs are highly related to output, the effects of overall wealth will be largely partialled out, strengthening the liklihood that school investment effects were indeed operating on levels of growth or decline in economic output. Note that the panel-analysis approach has been used to examine longitudinal effects of school growth on economic development and the reciprocal relationship (Meyer & Hannan, 1979; Benavot, 1982; Fuller, 1983).

Data Reduction Production-function models assume that different elements of economic activity (capital, labor, and output) are collected in a reliable fashion. Panel-analyses also benefit from the use of identical measures at two points when controlling on the prior level of economic activity. But such pure data are not always available within developing nations, especially detailed reports on early periods of growth. Composite measures were at times used as proxies for certain constructs. For example, the value of mining and textile manufacturing were reported for Mexican states in 1900; yet output for other industrial sectors, especially firms located in urban areas, was not reported. However, the volume of cigarette manufacturing and federal tax on this industrial sector were highly associated measures

(Cronbach's alpha=.70). This composite was used as a proxy for output in tobacco manufacturing. In addition, various measures of school investment and quality were reported. Principal components factor analyses were performed to determine patterns of clustering among various indicators, providing reliable composites. All indicators were adjusted to represent per capita levels of activity, except for ratios, such as the labor force participation rate or ratio of students per teacher.

Time 1 (1880) and Time 2 (1900) Measures Economic variables for Time 2 first consisted of the overall rate of participation in the formal labor market, given that precise workloads were not available by economic sector. A rate measure was used here to match per capita level of activity used for the other variables. Second, the amount of land under cultivation was estimated for each state based on agricultural volume figures (reported by crop) from 1900 and contemporary crop yield data (Secretaria, 1981).

A variety of capital investment indicators were available; three composites were constructed based upon inter-item reliability levels and the measures' expected relationship with related output variables. Production-functions were not built when an output measure could not be matched with a significantly associated measure of capital, given that the examination of school quality effects is useful only to the extent that other inputs can be adequately controlled. Capital investment in mining was measured by combining figures on the number, horsepower, and value of mining machines operating within each state (alpha=.91). The best measure of capital investment in textile manufacturing was the number of factories operating per capita. A measure of urban-based capital accumulation was used to examine the contribution of capital to tobacco manufacturing output. This construct includes level of capital investment in tobacco factories and concentration of landlords (alpha=.92). The composite was used as a measure of urban capital,

justifying the mix of capital from two sectors (Note 8) No capital investment measure was available for agricultural production. By most accounts farm work was highly labor intensive during the 1880-1900 period. Even large haciendas reportedly utilized very little machinery, other than work animals (Wells, 1887: Redfield, 1930).

A direct measure of the value of textile output was available for Time 2 (1900). Two measures of mining output, one for hacienda and one for all other mines, were combined into a composite (alpha=.84). A direct measure of the value of agricultural output was also reported. Finally, the measure of urban capital was matched with the indicator of tobacco manufacturing output described above.

For the panel analyses, two economic-activity control variables were available in Time 1 (1880) for each of three sectors. In agriculture, the value of land converted to cooperative farms was highly related to agricultural output in Time 2 (1900). Agricultural output in 1878 was also used as a control variable. Second, measures of the value of mineral exports and trade in non-metal goods (two indicators, alpha=.86) were highly related to both textile production and tobacco-related manufacturing, offering valid control variables.

Finally, several school investment and quality measures were narrowed down to two composites. A composite of local educational resources was built from six indicators which related to school expenditures, ratio of student attendance to enrollment, and availability of newspapers and libraries (alpha=.79). This composite basically tapped the level of municipal commitment to schools and institutions linked to literacy. A second composite was related to the availability of state and federal support of schools, which was independent of the first measure (alpha=.96). A direct measure of expenditures allocated per pupil in 1874 was also used. In addition, state

literacy rates were used as candidate variables (subject to the minimum standard for entering regressions, p .10). The 1900 literacy figure was used in production-function models, the 1880 estimated rate for the panel-analyses.

Time 3 (1925) and Time 4 (1945) Measures More complete figures on economic activity and school investments were published for the post-1917 period. For the production-function equations the overall rate of formal labor force participation was also used in Time 4 (1940). Direct measures of land cultivated with maiz and frijol were summed and used as an estimate of land. Investment in irrigation was used as an indicator of capital in the agricultural sector. In manufacturing, separate measures of total capital investment and the value of factory machinery per capita were combined into a composite (alpha=.88). A direct measure of total capital invested in mines was available for Time 4.

Agricultural output first was measured from the value of regionally exported maiz and frijol (alpha=.99). Second, the value of livestock produced and agricultural and commercial tax revenues shared considerable communality and were combined into a composite measure of agricultural output (alpha=.86). A direct measure of the value of mining was utilized. Manufacturing output was measured from the value of output, aggregate industrial wages earned, and state tax revenue levels (alpha=.92).

Finally, for the panel-analyses, a composite economic control for Time 3 (1925) for agriculture consisted of the reported value of rural and all farms (alpha=.88). In manufacturing, the composite included value-added to all manufacturing and capital investment in tobacco factories (alpha=.97). Finally, the value of exports, level of municipal taxes, and business tax revenues were combined into a composite measure of urban-based economic activity (alpha=.86). This Time 3 control variable was matched with a Time 4 direct measure of value of export activity.

Measures of school investment and quality were abundant for Time 3 (1925). Principal-components factor analysis indicated some degree of independence between the various measures. School investment measures analyzed here fall into the following categories:

1. Institution-Building: Relating to overall expenditures, numbers of schools constructed, and enrollment rates per capita.
2. Quality Within the School: Including measures of the student to teacher ratio, pupils' passage rate on annual exams, and teacher salary levels.
3. Sector-Specific Investment: Using separate measures of private, technical or vocational, and rural school investment.

Findings Results for the production-function models -- over the 1880-1900 period -- are reported in Table 4a. For the agricultural sector, the land variable is strongly significant in predicting output. Literacy (1900) enters significantly and holds a positive effect on output. Higher levels of state and federal support of schools is associated with lower agricultural output during this period. In mining, capital investment strongly determined value of output. School investment had no impact. Within the manufacturing sector, levels of capital investment contributed substantially to output. For textile manufacturing, literacy shows a negative effect. In the more urban-centered tobacco industry, expenditures per student increased output.

Table 4b reports findings for the panel models during this same era. In each sector, the Time 1 controls entered significantly, especially within the textile and tobacco elements of manufacturing. In agriculture, expenditures per pupil boosted output over the 1880-1900 era. The 1880 literacy rate appears to have had a positive influence on textile output, yet a negative effect on tobacco manufacturing. On the other hand, the negative

influence of literacy occurs in the equation after partialing out the positive effect of local educational resources.

Findings for the 1925-1940 period are reported in Tables 5a and 5b. The production-function models show that capital investment significantly affects output in each regression, except for the agrarian commerce output measure (where labor participation significantly enters). Higher levels of school investment and quality appear to positively boost output with the exception of the mining sector where private and rural school commitments lowered mining output. Heavier investment in school inspectors also seems to have depressed agricultural growth in this post-revolution period.

Table 5b illustrates findings for the corresponding panel-analyses. At least one of the Time 3 (1925) economic controls enters strongly for each economic sector. In agriculture, federal school expenditures positively boosted output. Sector-specific investments, in both private and technical schools, were negatively related to rural production (note that the private school variable is ratio of residents to private primary schools). The composite school quality measure--lower student/teacher ratios and higher attendance rates--increased export and trade activity. Here too, enrollment in technical schools diminished trade activity over this period.

Discussion Future Work These findings suggest that the level of school investment and the character of that investment historically influenced Mexico's economic output, at least within agricultural and manufacturing sectors. These patterns of influence differ somewhat between the two eras and the effects may not always be positive. For example, the level of school investment from central state and federal governments prior to the revolution appears to have been negatively associated with agricultural growth. This may have been due to the urban focus of schools during this time. State and federal funding may simply have reinforced municipal governments' emphasis on

improving schools in trading centers. And the local authorities were, after all, the major backers of schools at this point. After 1917 school investment -- now focusing on rural development -- held a positive influence on agricultural output. Two exceptions are important to note. Investment in technical schools and government inspection appear to be negatively related to output. Yet the number of primary schools per capita, teacher salary levels, and total federal expenditures for education all appear to exert a positive influence on agrarian output after controlling on states' wealth, capital investment, and land under cultivation. These findings appear for both the production-function and the panel-analysis models.

The contribution of school investment and quality to manufacturing output is less clear. First, conflicting positive and negative effects of literacy were observed prior to 1917 on textile output between the production-function model (using a direct capital investment control and the 1900 literacy rate) and the panel-analysis model (where Time 1 economic activity controls and the 1880 literacy rate were entered). These contrasting effects may be due to the different control measures or due to a change in literacy patterns between 1880-1900. Further work is needed to sort this out. One possibility, however, is that increased literacy drove up wages in textiles as modern sector jobs rapidly expanded for a fledgling middle-class during the late 19th century. Evidence does indicate that during this period the proportion of women textile workers rose from about 30 to 50 percent over this period, indicating changing labor demand patterns and perhaps a shift toward higher paying occupations for men (Chavez Orozco, 1937; Gonzalez Navarro, 1970). After 1917, school investment and quality (especially low class size and high student performance, Table 5a) appear to have raised aggregate manufacturing output. The strength of this production-function equation is evidenced by the fact that all three production inputs affected

output when entered as "controls" prior to school investment measures. This more consistent effect may be due to a higher rate of return on education when Mexico's industrial sector boomed prior to and during World War II (Reynolds, 1970a). This positive effect may have been an unintended consequence of rural school investment interacting with urban migration during this period of economic growth.

More thought should be given to the structure of school quality, particularly after 1917 when diverse measures become available. Our approach here has been to move beyond global measures of school attainment or expenditures per pupil, used in past economic growth and school quality research. Our initial investigation of the factor structure of school investment and quality yielded a variety of somewhat independent dimensions. Future work would reduce available measures into clearer indicators of school investment quantity and school quality.

In addition, the patterns discovered here should be examined in the post-1945 period. Rapid growth in Mexico continued into the 1950's. Some observers feel that post-revolution investments in education even more clearly came to fruition during this time. We also hope to move this analysis toward looking at school investment and economic growth within local economies. School attainment and economic data exist for Mexican municipios from 1900. Analysis of these data may yield a more fine-grained picture of whether and the extent to which school investments have helped shape Mexico's economic growth.

Table 1
School Growth in Mexico, 1843-1940

	1843[1]	1875	1888-93[2]	1925-28[3]	1936-40[4]
Number of primary schools	5,240	8,103	9,039	16,692	22,205
Municipal		(9,751)	(4,755)		8,831 (state)
State/federal			(4,284)	(3,943)	13,374 (federal)
Private/church		(2,017)		(2,998)	
School expenditures (millions of pesos)		2.8	3.3 (1907-11.3)	45.0	106.3
Municipal		(1.0)		(3.6)	(2.7)
State/federal		(0.4)		(41.4)	(103.6)
Private		(1.2)			
Annual School Expenditures per Student (pesos)					
Public		5.4	9.6	32.1	53.0
Private		24.0			
Literacy rate			14%-18%	33%	42%

Sources: 1. Data for 1843 and 1875 are from Dias Covarrubias (1875), Ortiz (1939).
2. Cuba (1893), Calcott (1931), authors' analysis, Note 2.
3. Vaughan (1982), Stanley (1948), and Note 2.
4. Stanley (1948), Note 2. All literacy data from (1970).

Note: All expenditure data are in current dollars. Between 1877-1900, the peso's value declined by 86 percent against the U.S. dollar (Sollano Ramos, 1961). From 1900 to 1920, absolute inflation in Mexico (not pegged to the U.S. dollar) rose by 21.6 percent. Between 1920-1940 the peso's value actually gained 2.5 percent (Wilkie, 1970).

Table 2

Mexico's Economic Structure:
Size of Gross Domestic Product (GDP) Components & Labor Market Sectors, 1900-1940

	1900		1930		1940	
	GDP	Employment	GDP	Employment	GDP	Employment
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Agrigulture [1]	29.9	65.9	23.7	70.2	23.0	65.4
Crop production	(14.3)		(13.1)		(12.6)	
Livestock	(15.6)		(10.6)		(10.4)	
Manufacturing	13.2	14.4	16.7	13.4	18.0	10.9
Mining	6.4	2.2	9.8	1.0	5.6	1.8
Transportation	3.1		2.8		5.3	
Other	47.4	17.4	47.0	15.4	48.1	21.9

1. Wilkie (1970) reports an overall decline in the agricultural employment sector from 68.3 percent to 63.4 percent between 1910-1940. Yet the size of rural labor force participation as a proportion of all active workers grew from 61.9 percent to 71.4 percent between 1900-1930, then dropped closer to Wilkie's reported level by 1940 (Reynolds, 1970a).

Table 2b

Annual Growth Rates of Mexico's Economic Sectors, 1900-1940

	1900-10	1910-25	1925-40
Gross domestic product	3.3%	2.5%	1.6%
Population	1.1	0.1	1.6
Real per capita GDP	2.2	2.4	0.0
Agricultural production	1.0	0.1	2.7
Manufacturing	3.6	1.7	4.3
Mining & petroleum	7.2	5.6	-1.9
Total exports	4.5	3.9	-1.4
Total imports	1.3	3.1	-3.5

Sources: Reynolds (1970a, 1970b)

Table 3

Contrasts Between Mexican States with High versus Low School Investment Levels (1)

	States with High School Investment (Means)	States with Low School Investment (Means)
Education Features, 1880-88		
School expenditures for instruction per capita	.51 peso	.16 peso
Literacy rate	29%	6%
Proportion all residents enrolled in school	5.6%	3.3%
Number residents per municipal supported school	1,420	1,969
Number residents per state and federal supported school	24,482	18,204
Number students enrolled per teacher	113	47
Proportion students presented year-end exams	44%	66%
Number residents per published newspaper	29,906	96,441
Economic Features, 1900-10		
Percent population living in towns 2,500[2]	57%	79%
Value of agricultural output per capita	10.3 pesos	9.8 pesos
Value of mining output per capita	9.3 pesos	4.0 pesos
Value of textile production per capita	3.0 pesos	4.3 pesos
Volume of cigarette production per capita	51 cigs.	12 cigs.
State government revenues per capita	1.7 pesos	1.2 pesos

1. High school investment states include, the Federal District, Veracruz, Sonora, Chihuahua, Jalisco, Nuevo Leon, and Morelos. Low school investment states include, Guerrero, Chiapas, Oaxaca, Michoacan, Tlaxcala, Queretero, and Durango. Selection of states based on reports by Wilson, (1941), Vaughan (1982), and our own data analysis.

2. Reported for 1910 by Wilkie (1970).

Sources: Authors' analysis, Note 2.

Table 4a
Influence of School Investments on Economic Output, 1874-1900
Production Function Models (1)

Economic Output 1900	Capital	Labor Participation	Cultivated Land Estimate	Local Commitment	School Investments (1880) State/Fed Resources	Expenditures Per Student	Literacy 1900	R-Square
Agriculture	--	1.10	.95***		-.51*		.85**	98%
		(1.93)	(.03)		(.27)		(.33)	
Mining	.22***	.92	.01					40%
	(.06)	(.83)	(.01)					
Manufacturing								
Textiles	1.89***	-.78	.02				-.83*	96%
	(.08)	(2.72)	(.04)				(.44)	
Tobacco Manf.	.42***	.15	.02			1.18**		55%
	(.09)	(.88)	(.01)			(.56)		

Table 4b
Influence of School Investments on Economic Growth, 1880-1900
Panel Analysis Models (1)

Economic Output 1900	Time 1 (1880) Economic Control(s)		Local Commitment	School Investments (1880) State/Fed Resources	Expenditures Per Student	Literacy 1880	R-Square
	Ejidos	Ag Output (1878)					
Agriculture	-5.06*	.54			4.11***		38%
	(2.99)	(2.12)			(1.26)		
Manufacturing							
	Non-Metal Trade	Metal Exports					
Textiles	-19.82***	1.10*				36.02*	54%
	(3.98)	(.64)				(18.38)	
Tobacco Manf.	- 1.04***	.13**	1.12***			- 5.32**	56%
	(.38)	(.06)	(.22)			(2.21)	

1. Unstandardized betas and standard errors are reported. Each model used logged values.
*** p<.01 ** <.05 * p<.10

Table 5a
Influence of School Investment on Economic Output, 1925-1945
Production Function Models (1)

	Economic Output (1945)			
	Agriculture		Mining	Manufacturing
	Crop Production	Ag Commerce		
Economic Factors, 1940-45				
Capital	-.07**	-.01	.011***	.87***
	(.03)	(.03)	(.002)	(.08)
Land cultivated	-.14***	-.02	.000	-.09***
	(.04)	(.04)	(.001)	(.02)
Labor participation	-.87	9.32**	-.03	8.14***
	(3.61)	(4.59)	(.15)	(2.13)
School Investment Measures, 1925-28				
Ratio school inspectors to primary schools	-17.50***			
	(5.33)			
Salary expenditures per federal school teacher	.49***			
	(.12)			
Federal expenditures per student and per capita		.47**		
		(.20)		
Literacy rate, 1940		7.67***		
		(2.41)		
Proportion school-age children enrolled in private primaries			-2.31**	
			(1.10)	
Ratio of rural schools to rural school-age children			-.12)*	
			.06)	
Proportion school-age children enrolled in federal primaries				31.62***
				(5.63)
Small class size/student pass rate (composite)				1.72***
				(.49)
R-Square	59%	67%	52%	92%

1. Unstandardized betas and standard errors reported. All variables reported are for logged values. ***p <.01 **<.05 * p<.10

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Table

Influence of School Investments on Economic Growth, 1925-1945

Panel Analysis Models (1)

	Economic Output by Sector (1945)			
	Ag/Crop Production	Mining	Manufacturing	Export Activity
	Farm Value	Exports/Muni Tax	Value Textile Output	Exports/Muni Tax
Time 1 (1925)	.41***	.01**	-.3	.08***
Economic Control(s)	(.14)	(.005)	(43.6)	(.01)
			Value-Added Manf.	Value-Added Manf.
			.69**	.04**
			(.32)	.02)
School Investment Measures, 1925-28				
Federal expenditures	.36***			
	(.12)			
Residents per private primary school	.0001***			
	(.00004)			
Enrollment rate in federal technical school	-6.69*			-.60***
	(3.40)			(.19)
Students enrolled per federal primary school				2.86**
				(.62)
Ratio of students to teachers, all primary schools				-.06***
				(.02)
R-Square	53%	14%	16%	85%

1. Unstandardized betas and standard errors reported. All variables reported are for logged values with one exception. The regression run for agricultural crop out is for raw per capita values, given the weakness of the Time 1 economic control variable when all values were logged.

*** $p < .01$ ** $p < .05$ * $p < .10$

Notes

1. Barnhouse-Walters & Rubinson's findings are not conclusive as they point out. Their regression models for the early U.S. industrial period were at times not stable where the measure of capital took on a negative coefficient. Unstable or weak effects for some capital investment indicators were apparent for a small subset of models we tested pertaining to Mexico. These equations were subsequently dropped.

2. Following are the primary sources of data.

a. Population, occupational, social, and literacy data from decennial census documents:

Dirección General de Estadística, México, D.F.
(1900-07) Segundo Censo de Población, 1900 (Vols. 1-21)
(1918) Tercer Censo de Población, 1910 (Vols. 1-30)
(1932) Quinto Censo de Población, 1930 (Vols. 1-32)
(1943) Sexto Censo de Población, 1940 (Vols. 1-30)

Departamento de Estadística, México, D.F.: Talleres Gráficos de la Nación (1925) Cuarto Censo General de Población, 1921 (Vols. 1-31)

Secretaría de Programación y Presupuesto (1982) Décimo Censo General de Población y Vivienda, 1980: Resolutados Preliminares Nivel y por Entidad Federativa. Mexico, D.F.

b. School data:

Direccion General de Estadística (1896) Estadística General de la República Mexicana, 1884-1896 (Vols. 1-10). Mexico, D.F.

Gobierno de Mexico (1888) Boletín Semestral de la Estadística. México, D.F.

Penafiel, A. (1901) Anuario Estadística de la República Mexicana, 1900. Mexico, D.F.: Oficina Tipográfico de la Secretaría de Fomento.

Secretaría de Instrucción Publica y Bellas Artes (1909) Boletín de Instrucción Publica. Mexico, D.F.: Tipografia Economica.

Secretaria de Instruccion Publica y Bellas Artes (1911) Boletin de Instruccion Publica. México, D.F.: Imprenta de Stephan y Torres.

Secretaría de Educación Pública (1926) Boletín de Instrucción Pública. Mexico D.F.

Secretaría de Educación Pública (192/) Noticia Estadística Sobre la Educación Publica de Mexico, 1925. Mexico, D.F.: Talleres Graficos de la Nacion.

Secretaría de Educación Pública (1929) Noticia Estadística Sobre la Educación Publica de México, 1927. Mexico, D.F.: Talleres Gráficos de la Nación.

c. Economic data:

Busto, E. (1880) Estadística de la República Mexicana. México, D.F.: Imprenta de Ignacio Compliado.

Penafiel, A. (1888-89) Estadística de la República Mexicana, Nos. 1 & 2. México, D.F.: Oficina Tipográfico de la Secretaría de Fomento.

Penafiel, A. (1912) Anuario Estadístico de la República Mexicana, 1907. México, D.F.: Oficina Tipográfico de la Secretaría de Fomento.

Secretaría de Estado y del Despacho de Hacienda, Crédito Público y Comercio (1913) Anuario de Estadística Fiscal. México, D.F.: Tipográfico de la Oficina Impresora de Estampillas.

Departamento de la Estadística Nacional (1926) Anuario Estadístico: Censo y Demografía, Vida Económica y Vida Social y Moral, Vol. II. México, D.F.: Talleres Graficos de la Nacion.

Departamento de la Estadística Nacional (1930) Anuario Estadístico: Comercio y Navegación. Mexico, D.F.: Talleres Graficos de la Nación.

Departamento de la Estadística Nacional (1932) Anuario de 1930, No. 16. Talleres Gráficos de la Secretaría de Agricultura y Fomento.

Secretaría de la Economía Nacional, Dirección General de Estadística (1939) Anuario Estadístico. Mexico, D.F.: Talleres Gráficos de la Nación.

Secretaría de la Economía Nacional, Dirección General de Estadística (1943) Anuario Estadístico de los Estados Unidos Mexicanos. México, D.F.: Dirección General de Estadística.

3. A private association, La Compania Lancasterana operated schools according to Lancasterian ideals advocated in Europe. The emphasis on strict order and rote instruction blended well with teaching the church catechism. These schools were later absorbed by municipal school authorites, and provided a transition between religious and secular institutions in both content and method. At the end of the 19th century Lancasterian schools were outlawed as remnants of a non-modern, constraining social order of the past (Barranco, 1915).

4. The struggle within schools to appear modern at times took rather awkward turns. One school textbook, urged on municipal schools by the federal government, included instruction in how to celebrate the U.S. holiday of Thanksgiving (Secretaría, 1905).

5. Rising school appropriations reflected a substantial shift in federal social policies. Between 1920-1927 the annual budget for national defense declined by 40 percent, 124 to 76 million pesos (Calcott, 1931). Between 1920-1945, federal budget appropriations increased from 25.7 to 105.6 (1950 constant) pesos per capita (Wilkie, 1970).

Increasing federal support of Mexican schools has continued. The federal share currently stands at 70 percent of all funding. State governments provide 22 percent of all funding, and private sources (e.g.,

industrial and agricultural company schools) cover the remaining eight percent (Neumann & Cunningham, 1982).

6. Recurrent efforts by Latin American governments (state and federal) to encourage cooperative action and attitudes are explored by Van Young (1984) in the Guadalajara region and Bak (1983) in Brazil.

7. In the early 1880's Mexico's annual agricultural production was comprised of the following major crops: maiz (US$112 million), wheat ($17 million), sugar ($9 million), frijol or beans ($8 million), cotton ($7 million), coffee ($2.6 million), tobacco ($2.0 million).

8. This composite measure of tobacco manufacturing and concentration of landlords is a valid indicator of urban-centered capital accumulation in 1900. The correlation between this composite and the proportion of residents living in towns of 2,500 or less equals -.67 (p .001). However, by 1940 the correlation between manufacturing output and this rural measure equals, -.33 (p .06).

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